Sept. 24, 1968 K. GUDDAL 3,402,522

METHOD OF MAKING A CAST IN PLACE WALL

Filed May 21, 1965 3 Sheets-Sheet 1

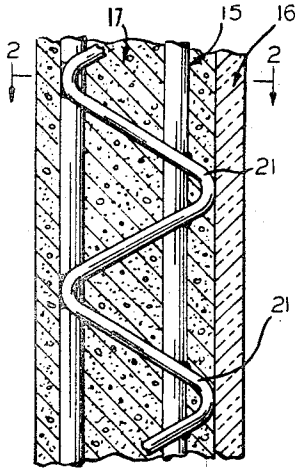


FIG. 1

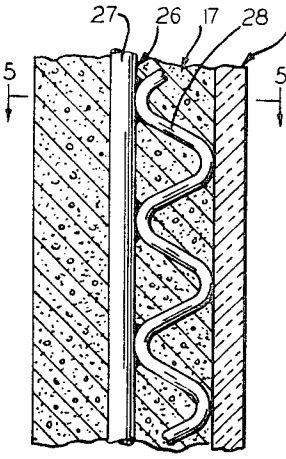


FIG. 4

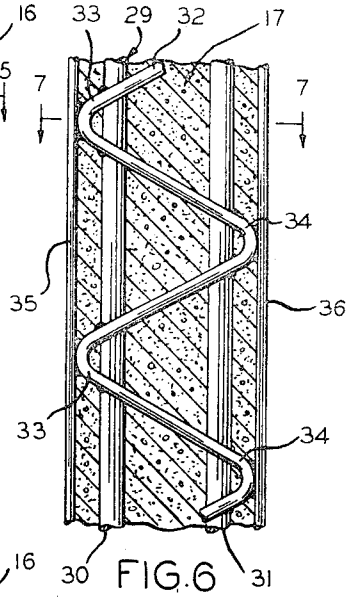


FIG. 6

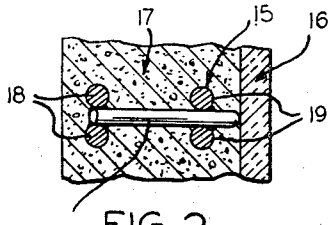


FIG. 2

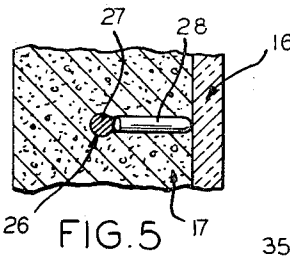


FIG. 5

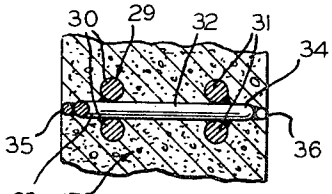


FIG. 7

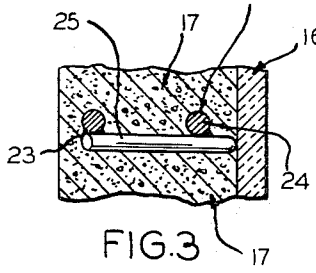


FIG. 3

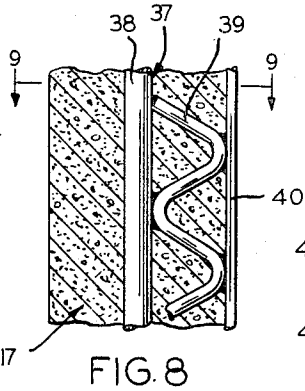


FIG. 8

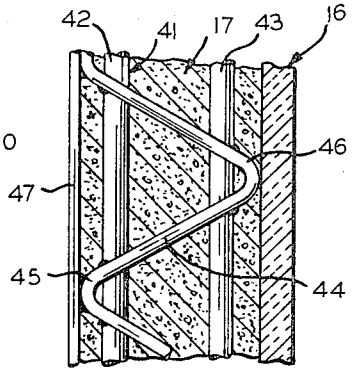


FIG. 10

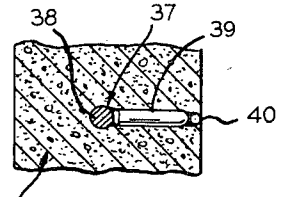


FIG. 9

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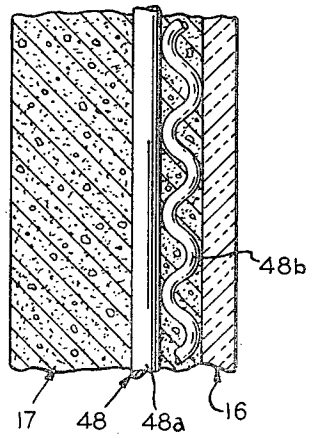
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METHOD OF MAKING A CAST IN PLACE WALL

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FIG. 11



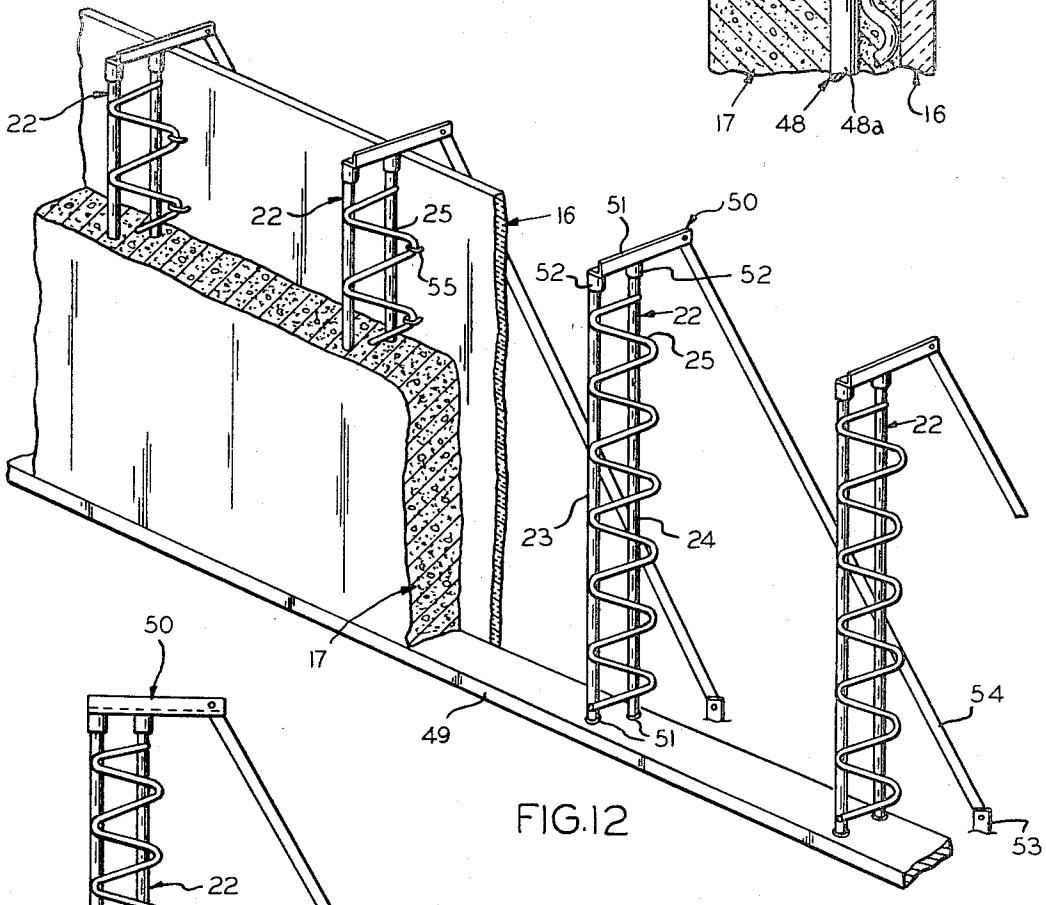


FIG. 12

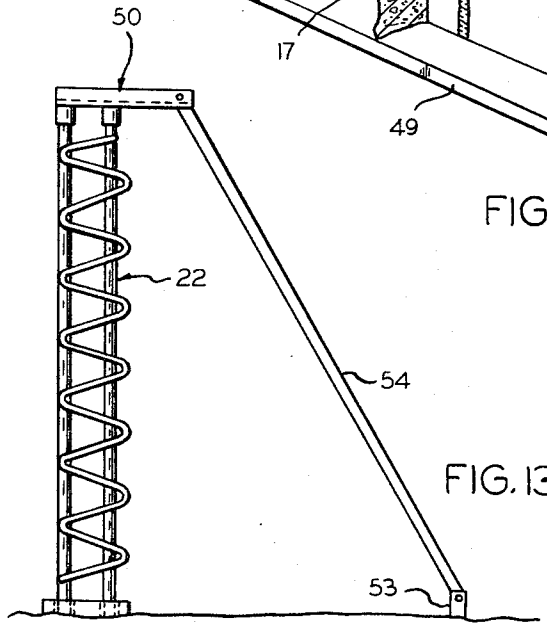


FIG. 13

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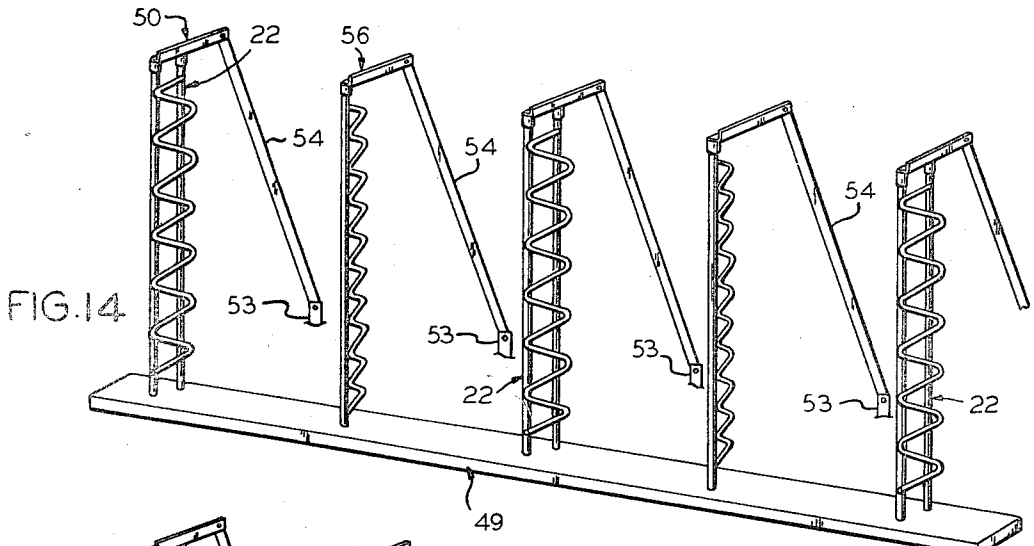


FIG. 14

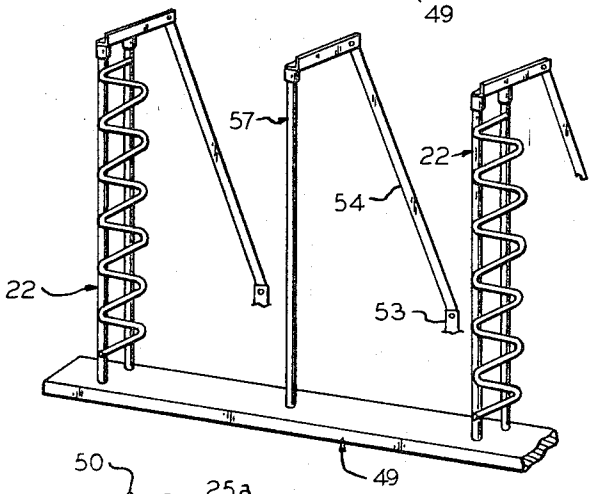


FIG. 15

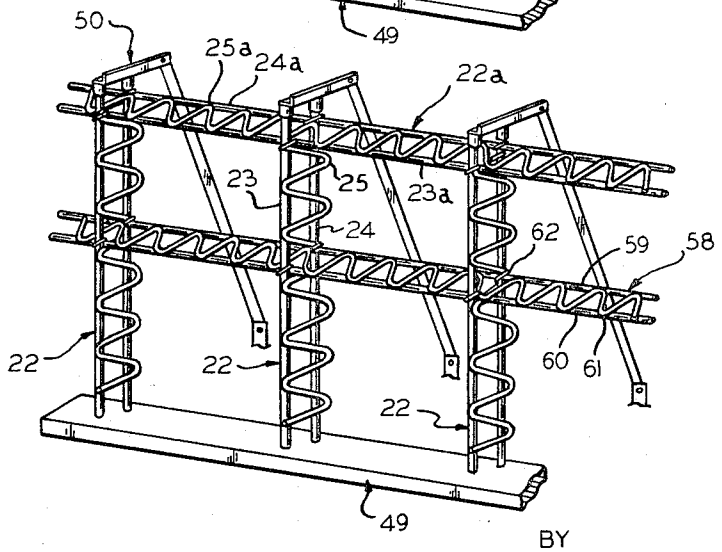


FIG. 16

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United States Patent Office 3,402,522 Patented Sept. 24, 1968

3,402,522

METHOD OF MAKING A CAST IN PLACE WALL

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Continuation-in-part of application Ser. No. 381,318, July 9, 1964. This application May 21, 1965, Ser. No. 457,611

2 Claims. (Cl. 52—741)

This application is a continuation-in-part of my application Ser. No. 381,318, now Patent No. 3,364,640, filed July 9, 1964.

This invention relates in general to a wall construction for a building and method of making same, and more particularly to a building stud for use in wall construction of a building, and still more particularly to a building stud capable of giving guidance to the construction of a wall.

The building stud of the present invention is especially useful for reinforcing walls primarily constructed of cementitious material, including concrete, cement mortar and the like. Preferably, the building stud is of steel, although it may be of any other suitable material capable of providing suitable reinforcement for cementitious material. It should also be appreciated that while the stud of the present invention will be described and illustrated for wall construction, such wall construction includes vertical and horizontal panels and thus could be employed for ceiling and floor construction.

The wall construction of the present invention includes the use of a plurality of building studs arranged in spaced coplanar relationship and embedded in concrete to provide a concrete reinforced wall structure. The method of making the wall construction involves erecting a plurality of spaced coplanar building studs, all of one configuration or of mixed configurations, anchoring the studs at their opposite ends, and embedding the studs in concrete. If the wall construction is to be vertical, the studs would be anchored at the bottom against displacement from a predetermined position such as by a plate having holes therein for receiving the lower ends of the studs, and at the top by a bracket engaging the upper end of the studs and suitably supported to hold its position. The concrete may be applied by positioning forms about the studs and pouring into the forms, or by pneumatic placement where a backing member (form or sheet of insulation) is secured along one side of the studs and the concrete is applied from the other side by being propelled against the studs and backing member. In the latter case, the studs form support for the concrete as it is applied to hold it in place.

In one embodiment of the invention, a building stud adapted to be embedded in concrete includes reinforcing bar means having a web or truss means secured thereto for guiding the placement of a prefinished panel or a panel of insulation or just a temporary form panel so that the bar means is spaced therefrom and can be then completely embedded in the concrete material. It should also be appreciated that the reference to concrete herein is intended to refer to any suitable cementitious material for use in building construction.

In another embodiment of the invention, a screed or border bar may be attached to the web or truss for defining a guide to adjust the thickness of a wall so that the wall may be maintained straight and plumb, and so that uniform thickness can be obtained.

It is therefore an object of the present invention to provide a new and improved wall construction and method of making same.

A further object of the invention is to provide a new and improved building stud for wall construction.

Another object of this invention resides in the provision of a building stud for wall construction that is capable of providing a guide for wall thickness and for the placement of a backing panel so that the main reinforcing bars of the stud can be completely embedded in concrete material.

Still another object of this invention is to provide a building stud for wall structures that is capable of giving a wall greater strength and additional fire protection.

A further object of this invention is to provide a building stud for wall construction that is capable of enhancing the construction of the wall when employed with concrete, wherein the stud includes means for guiding the uniform thickness of the wall and to enhance the plumbing of the wall surface.

A still further object of this invention is to provide a wall construction including building studs and cementitious material that is more economical to construct than heretofore reinforced cementitious material structures, and which provides materially greater strength.

Other objects, features and advantages of the invention will be apparent from the following detailed disclosure, taken in conjunction with the accompanying sheets of drawings, wherein like reference numerals refer to like parts, in which:

FIG. 1 is a fragmentary vertical sectional view taken through a wall employing a building stud in accordance with the present invention;

FIG. 2 is a fragmentary horizontal sectional view of the wall of FIG. 1, taken substantially along lines 2—2 thereof;

FIG. 3 is a horizontal sectional view like that of FIG. 2 but illustrating a modification wherein only a pair of spaced vertical bar members are employed;

FIG. 4 is a fragmentary vertical sectional view of a wall embodying a further modification of the building stud according to the present invention wherein only a single vertical bar is provided;

FIG. 5 is a fragmentary horizontal sectional view taken substantially along line 5—5 of FIG. 4;

FIG. 6 is a fragmentary vertical sectional view taken through a wall and illustrating a further modified building stud according to the present invention that includes screed or border bars for aiding in the construction of the wall to a uniform thickness;

FIG. 7 is a fragmentary horizontal sectional view taken substantially along line 7—7 of FIG. 6;

FIG. 8 is a fragmentary vertical sectional view taken through a wall and is a further modification of a building stud according to the present invention and particularly a modification of the stud shown in FIGS. 6 and 7, wherein only a single vertical member and screed bar is shown;

FIG. 9 is a fragmentary horizontal sectional view taken substantially along line 9—9 of FIG. 8;

FIG. 10 is a fragmentary vertical sectional view taken through a wall and illustrating a still further modification of the present invention;

FIG. 11 is a cross-sectional view showing a building stud according to the invention constructed similarly to the building stud of FIG. 4 but positioned closer to one side of the wall than the other;

FIG. 12 is a perspective view of a wall construction in accordance with the present invention showing some parts cut away and others removed for purposes of clarity;

FIG. 13 is a side elevational view of the bracket ar-

rangement for supporting a building stud in erected vertical position during the construction of the wall;

FIG. 14 is a perspective view, somewhat diagrammatic, illustrating a building stud arrangement different from that shown in FIG. 12;

FIG. 15 is a view similar to FIG. 14 but showing still another arrangement of building studs for a wall construction according to the present invention; and

FIG. 16 is a view similar to FIGS. 14 and 15 but illustrating still another arrangement of building studs for the wall construction of the present invention.

Referring now to the drawings, and paritcularly to FIGS. 1 and 2, a wall is shown including a building stud **15** having a panel **16** at one side wherein the stud is embedded in concrete **17**.

The stud **15** includes a pair of inner verticaly arranged reinforcing bars **18** in substantially parallel spaced relationship with a pair of outer vertically arranged reinforcing bars **19**. A sinuously shaped web or chord **20** extends between the spaced bars **18** and **19** and also between each of the bars **18** and each of the bars **19**. The web or truss **20** is suitably secured to the bars **18** such as by welding or the like so that the bars **18** and **19** and the web **20** essentialy comprise an integral unit. The web **20** may be of any desired cross-sectional configuration such as circular as shown and is arranged so that the portions thereof secured to the bars **18** do not extend beyond the outer edges thereof, while at the same time the portions secured to the bars **19** are arranged to extend beyond the outer edges thereof to define extensions **21** that serve to space the panel **16** a distance from the bars **19**. It can be appreciated that the extension **21** may be made greater or smaller depending upon the distance desired for spacing the panel **16** from the bars **19**. The vertical reinforcing bars **18** and **19** may also take any desired cross-sectional configuration although they are shown circular in the present drawings.

The panel **16** may be of insulated material if it is desired to be an outside wall surface or it may be of a prefinished material if it is to be an interior wall surface. Any suitable means (not shown) may be employed for securing the upper and lower ends of the stud **15** in a self-supporting manner prior to the mounting of the panel **16** and the application of the concrete **17**. As in conventional wall construction, it will be appreciated that the studs **15** would be spaced along the wall any desired distance in order to obtain the strength of the wall desired and to accommodate the particular sizes of the panel **16**. Further, the spacing of the bars **18** and **19** may be adjusted in accordance with the desired thickness of the wall and the reinforcing desired. It should be further appreciated that the concrete **17** may be applied in any suitable manner such as pneumatically or otherwise.

Hence, it can be seen that the bars **19** will be spaced from the panel **16** by means of the spacing extensions **21** so that the bars **19** are completely embedded in the concrete and thereby enhance the overall strength of the wall and provide greater fire resistance. Quite obviously, the bars **19** can therefore function as better reinforcing members since they are embedded in the concrete **17**.

Referring now to FIG. 3, a modified building stud **22** is shown which differs from the stud **15** only in that a single vertically arranged reinforcing bar **23** is provided on one side of the stud and a single vertically arranged reinforcing bar **24** is provided on the other side of the stud, both of which are secured together by means of a web **25**. It will be appreciated that any number of vertical bars may be employed in any one building stud.

The embodiment of FIGS. 4 and 5 differs from the previous embodiments only in that the building stud **26** includes a single vertically arranged reinforcing bar **27** having a web **28** secured to one side thereof for spacing the panel **16** from the bar **27**. This stud would be employed where a thinner wall structure could be used.

The embodiment of FIGS. 6 and 7 illustrates a building stud **29** having pairs of parallel spaced vertically arranged reinforcing bars **30** and **31** interconnected by a sinuously shaped web or truss **32**. In this embodiment, the web **32** includes spacing extensions **33** extending beyond the bars **30** and spacing extensions **34** extending beyond the bars **31**. The web **32** is suitably secured to the bars **30** and **31** as in the previous embodiments. Vertically arranged screed or border bars **35** and **36** are suitably secured as by welding or otherwise to the extensions **33** and **34**, respectively. Again, the reinforcing bars **30** and **31** are embedded in the concrete **17** and the screed bars **35** and **36** define a guide for the thickness of the concrete and also serve as a guide to keep the inner and outer wall surfaces straight and plumb. Any suitable means may be provided for applying the concrete to the studs, such as by pneumatic application and wherein some lathing may be provided in the center of the wall to initially receive the first layers of concrete. In an actual wall construction, the stud **29** may be alternately employed with the stud **15** or the stud **26** or any other stud as the screed guiding need not be on every stud.

Referring now to FIGS. 8 and 9, a modification of the stud of FIGS. 6 and 7 is shown wherein the stud, generally indicated by the numeral **37**, includes a single vertically arranged reinforcing bar **38** having a sinuously shaped web **39** extending from one side thereof. A screed or border bar **40** is secured to the web **39**. In this embodiment, it would not be critical as to the plumbing of the concrete surface on one side but it would be desired to have a guide on the side having the screed bar **40**.

Referring now to the embodiment of FIG. 10, a stud **41** is shown which combines the features of the studs of FIGS. 1–5 and the studs of FIGS. 6–9, wherein the stud is capable of providing a guide for the positioning of the paneling **16** on one side and for the guidance of the wall thickness and plumbing on the other side. This stud includes vertically arranged reinforcing bars **42** and **43** interconnected by a web or truss **44** having spacing extensions **45** extending from the bar **42** and spacing extensions **46** extending from the bar **43**. The spacing extensions **46** serve to space the paneling **16** from the vertical reinforcing bar **43**, while a screed or border bar **47** is suitably secured to the spacing extensions **45** for the purpose of guiding the thickness of the wall and the thickness of the concrete beyond the bar **42**. This stud, like the stud **29**, may also be alternately employed in a wall structure with any of the other studs shown.

It should be appreciated in all of the embodiments, the reinforcing bars and webs are suitably interconnected by welding or the like and that where screed bars are provided, they are also connected by welding or the like to the webs. Further, while the webs or trusses are illustrated as being sinuously shaped, it should be appreciated that they may take other forms so long as they provide means for interconnecting the spaced reinforcing bars or so long as they provide spacing extensions for spacing the paneling or for having secured thereto screed or border bars.

The embodiment of FIG. 11 differs from the embodiment of FIG. 4 primarily in that the wall construction includes a building stud **48** that is positioned within the concrete **17** closer to one side of the wall. In this embodiment, the building stud **48** includes a reinforcing bar **48*a*** having a web or truss member **48*b*** suitably connected thereto by welding or the like and which serves to space the reinforcing bar **48*a*** from the backing panel or sheet **16** during the formation of the wall and the application of the concrete **17**. It should be appreciated that in some instances, the strength given to the concrete wall by a building stud will be more desirous along one side of the wall than the other side because of the use put to the wall structure. Thus, the placement of the building stud **48** could be at any position between the opposite sides

of the wall structure as long as it is embedded within the concrete **17**.

Referring now to FIGS. 12 and 13, a wall structure according to the present invention is illustrated including the manner of positioning and supporting the building studs **22** during construction of the wall. This arrangement includes a bottom plate or anchor member **49** and a plurality of brackets **50**. The building studs **22** are suitably spaced along the anchor member **49** and means is provided to prevent displacement of the lower ends of the studs. For example, openings **51** may be provided in the anchor member **49** to receive the lower ends of the reinforcing bars **23** and **24** of the stud so that the lower end of the stud is anchored or positively positioned relative to the anchor member **49** and relative to adjacent studs. Alternately, fastening members may be shown to secure the lower ends of the vertical reinforcing bars of the building stud in position along the anchor member **49**. Further, the planes of the building studs would extend substantially perpendicularly to the anchor member **49**. It should be appreciated that any other suitable means may be provided to hold the lower ends of the building studs in position.

The upper ends of the building studs **22** are held in position by the brackets **50** which include a bar **51** having a pair of socket members **52** secured thereto for receiving therein the upper ends of the vertical reinforcing bars **23** and **24** of the building stud **22**. One end of the bar **51** extends beyond the area of the wall structure and is anchored to a ground post **53** by a connecting bar **54**. It should be appreciated that any suitable bracket and positioning means may be employed which engages the upper ends of the studs **22** and is suitably anchored with respect to the anchor member **49** to properly hold the vertical studs **22** in position during construction of the wall. After the wall has been fully constructed, the brackets **50** may then be removed as the wall will then be self-supporting.

As seen in FIG. 12, the forming member **16** which may be a sheet of insulation or removable after the wall has been completely constructed is attached to the webs **25** of the studs by means of fasteners **55**. Following the anchoring of the building studs at the upper and lower ends by the brackets and anchor member, and the securing of the backing sheet **16** to the building studs, the concrete **17** may then be applied pneumatically. Application of the concrete **17** in accordance with the invention would alternately be by blowing the concrete in dense form against the building studs and backing member **16** until the concrete is of the desired thickness to embed the building studs. The concrete is blown on first at the lower ends of the studs and then gradually up to the top, wherein the building studs serve as supporting members for the concrete as it is applied. This is the preferable manner of constructing this wall structure, although the use of another form opposite to the member **16** would enable pouring of the concrete between the forms and about the building studs.

Referring now to FIG. 14, a modified building stud arangement for the wall structure of the present invention is illustrated wherein the placement of building studs **26** between building studs **22** serves to reduce the building stud cost where possible. This illustrates that it is not necessary to make the wall construction of the present invention with building studs of the same type throughout its length. Thus, the structure of FIG. 14 shows the alternate usage of building studs **22** and **26**. In this embodiment, it can be appreciated that the brackets **56** for supporting the upper ends of the building studs **26** merely differ from the brackets **50** in that only a single socket is employed for anchoring the upper ends of the building studs **26** that are provided with only a single vertical reinforcing bar.

The embodiment of FIG. 15 differs from the embodiment of FIG. 14 only in that the building stud employed between adjacent building studs **22** is of a different configuration than the building stud **26** in FIG. 14. This building stud, designated by the numeral **57**, merely comprises a single vertical reinforcing bar and is void of a truss or web for spacing of the stud from a side of the wall, this function being adequately accomplished by the building studs **22**. It should be appreciated that the building stud **57** may be arranged at any desired depth in the wall structure depending upon the needs of the installation.

The embodiment of FIG. 16 illustrates the use of building studs arranged in horizontal position where it is necessary to provide further reinforcing in the wall structure along the longitudinal axis thereof. In this embodiment, a plurality of building studs **22** are arranged in vertical position and spaced longitudinally along the anchor member **49** and being suitably supported by brackets **50** at their upper ends. A top reinforcing horizontal stud **22A** is positioned over the upper end of the building studs **22** and arranged so that its plane is normal to the vertical studs **22**. In this embodiment, the reinforcing bar **23A** is received along the inner sides of the vertical reinforcing bars **23** of the studs **22**. Similarly, the reinforcing bar **24A** may be received along the insides of the reinforcing bars **24** of the studs **22**, while the web or truss **25A** at the building studs may be looped around the vertical reinforcing bars **24**. This horizontally arranged building stud **22A** may have the reinforcing bars **23A** and **24A** spaced slightly closer together in order to fit within the vertical reinforcing bars **23** and **24**. Suitable wires or other fasteners may be employed to temporarily position the building stud **22A** along the upper ends of the building studs **22** while the concrete is being laid up.

If further longitudinal reinforcing is desired, the horizontal stud **58** may be employed anywhere along the vertical of the building studs **22**. This stud would include parallel opposed reinforced bars **59** and **60** interconnected by a web or truss **61** that would merely be arranged to interconnect the bars **59** and **60**. This horizontal building stud could be arranged between the opposed reinforcing bars **23** and **24** of the building studs **22** and thereafter be suitably fastened and held in position by wire or the like **62**. It should be appreciated that either or both of the horizontal building studs **22A** and **58** may be employed for further strengthening the wall structure with the building studs **22**.

It will be understood that modifications and variations may be effected without departing from the scope of the novel concepts of the present invention, but it is understood that this application is to be limited only by the scope of the appended claims.

The invention is hereby claimed as follows:

1. The method of making an upstanding reinforced concrete panel including a plurality of building studs some of which include a pair of parallel reinforcing bars interconnected by a sinuous chord member having portions extending from one of the bars to guide construction of the panel and placement of the studs therein, said method comprising the steps of erecting a plurality of said building studs into upright coplanar and horizontally spaced relationship with the plane of the studs extending normal to the long axis of the panel, applying means to the lower ends of said studs to hold same against movement, applying removable means to the upper ends of said studs to hold same in position and against displacement, securing a sheet of imperforate rigid material to the sinuous chord member portions in spaced relation to the reinforcing bars along one side of the studs, and pneumatically applying concrete against the studs and sheet of material until the parallel reinforcing bars of the studs are completely embedded in the concrete.

2. The method as defined in claim **1**, including the securing of a horizontally extending building stud to said upright studs before application of the concrete.

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